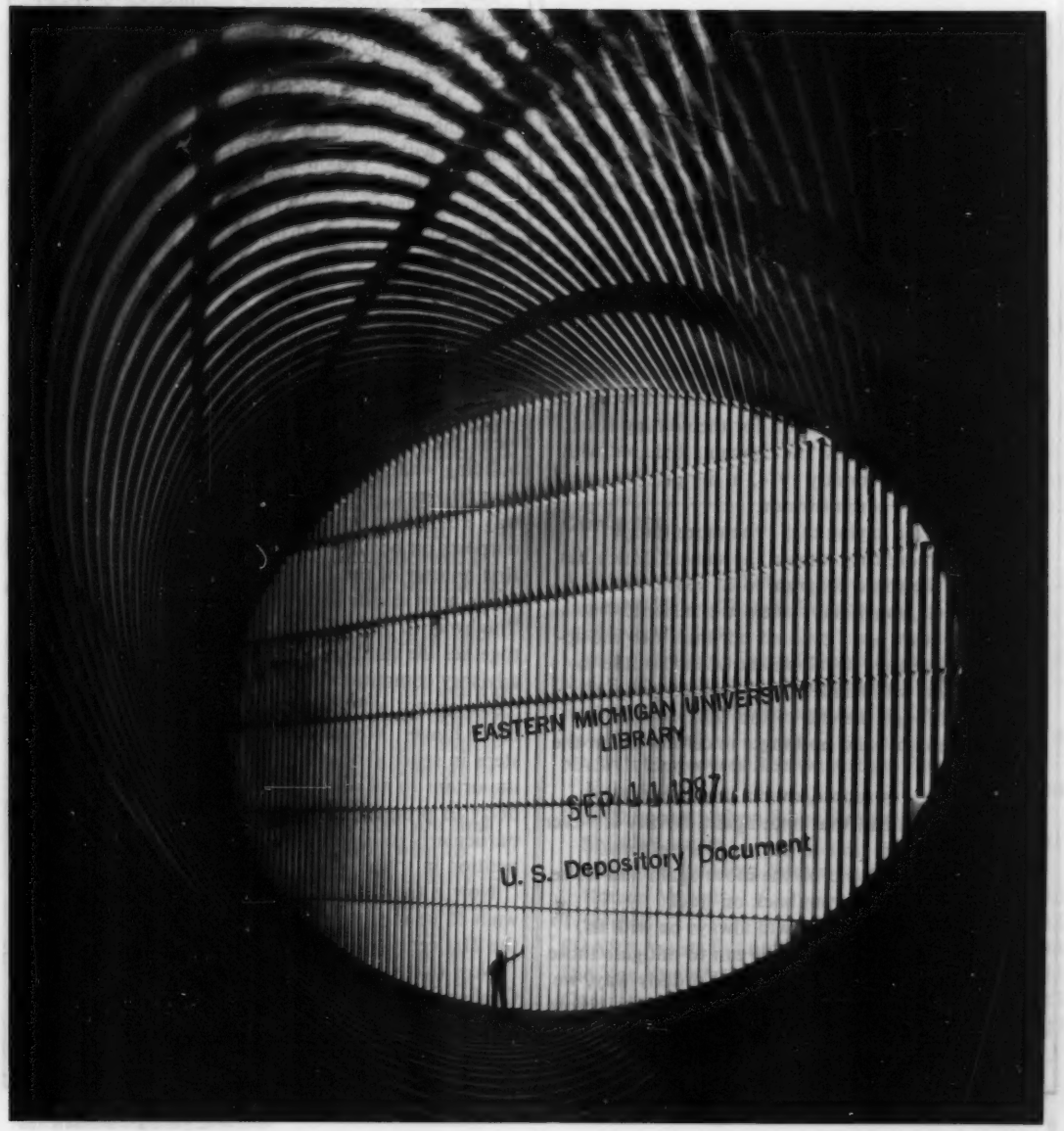
NAS 1.46: 18/6,7
DOCUMENTS

# NASA Activities

National
Aeronautics and
Space
Administration

1987
Vol. 18, No. 6 & 7



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# Administrator's Column

*(The following are excerpts of a speech given by NASA Administrator Dr. James C. Fletcher. The speech focuses on a topic of broad interest to NASA employees and was presented on February 25, 1987 at the National Space Club, Washington, D.C.)*

I welcome this opportunity to talk about the status of NASA and our future plans. We at NASA have always appreciated the high level of support the National Space Club has given to our program. That support is even more crucial today, as we work to prepare the nation for a new era of space activities, one more stable, more reliable and — one we fully expect will be safer than before.

It has become traditional for NASA administrators to address this club over the years, following the president's budget submission for the coming fiscal year. I decided to review the thoughts I shared with this club back in February 1974, in my previous incarnation as NASA administrator.

There's an old saying that "the more things change, the more they remain the same." Much has changed in the space program in 13 years, but in many respects, much has remained the same.

Thirteen years ago I pointed out that with the approval for intensive development of the Shuttle in FY 1975, and with challenging planetary programs approved through the end of the '70s, we were "over the hump" and no longer uncertain about the future.

I am pleased to report, over a year after the Challenger accident, that once again, NASA is "over the hump" — this time in our recovery efforts. We're on the mend and on the move again and we're getting the space program back on track.

The risks of space flight will always be with us, but we are doing everything we can to mitigate those risks. Step by step, in a careful and orderly way, we are working not to get back to where we were before Challenger, but to get ahead of where we were. We are moving out from the shadow of Challenger and looking to the future.

Thirteen years ago, I shared with you some of the questions I was getting asked then about the future of the space program. Today I am getting asked the same questions, and they are:

"When will Americans return to the Moon? When will we land men on Mars? When will we establish a large Space Station in Earth orbit?"

I will try to answer them as best as I can, in the crucial context of American leadership in space.

Let's start with the Space Station. We're well on track in developing a pretty sophisticated Space Station. This clearly is a necessary step to return to the Moon or to land men on Mars.

As you know, we have completed an intensive preliminary design and definition phase in conjunction with our international partners and are looking forward to the beginning of development this year. Plans now call for the Space Station to be in operation by the mid-1990s. And we have every hope and expectation that our friends in Europe, Canada and Japan will be on board as well, to share in the benefits.

The Space Station will be the central focus of all our efforts to expand science, commerce and technology in space through the end of the century and beyond. As you know, the Paine Commission report views the Space Station as an essential first step in building what it calls a "highway to space" over the next 50 years. As the Commission sees it, that highway would lead in a succession of steps to manned outposts on both the Moon and on Mars during the first quarter of the 21st century.

We must decide soon on the next step along that "highway to space." Dr. Sally Ride is pulling together the thinking within NASA and its various advisory committees to help make that decision.

We cannot afford to put that decision on hold much longer. We must decide soon what our next steps in space should be. The space program is too important to all of us and to our national future to delay its progress or allow it to veer off course — particularly in light of increasing international competition in space.

Now is the time for Americans to decide where we want to be in space in terms of world leadership in the 21st century — only 13 years away.

Now that we are down for 2 years following the Challenger accident, we need to look squarely at the facts.

cont. on pg. 4

# James M. Beggs Charges Dropped

The U.S. government recently dismissed its indictment of former NASA Administrator James M. Beggs and his three former colleagues from General Dynamics for lack of evidence.

At a press conference held in Washington, D.C. on June 22, 1987, Mr. Beggs said he has been working as a consultant in high technology since leaving NASA. He added that he will continue to support NASA and the space program. "Now that this ordeal is behind me, I'll try to speak out and help the agency and the program from my position as a private citizen," he said.

The following are excerpts from Mr. Beggs' press conference statement:

Nineteen months ago — on Thanksgiving Eve 1985 — my family and I were plunged into a nightmare when we learned that the government planned to indict me and three former General Dynamics colleagues on alleged criminal fraud charges.

Today, I am pleased to say that nightmare is over.

When all this began, I said the charges were groundless and predicted I would be vindicated. I never expected the case to proceed; and, when it did, I never expected it to last so long.

On a more personal note, two good things came out of this for me.

First, my daughter Kate took leave of her job with a New York law firm and showed up at my doorstep to help defend me. Her advice, support and dedication were invaluable to me and of great comfort to my family.

Second, it's often said that in adversity you find out how many good friends you have. I want to thank my many good friends around the country — particularly those at NASA — for their unflagging support over these very difficult months. They warmed my family's hearts and lifted our spirits.

Finally, a word about our system of justice. In this case, the system worked — but not well enough. I hope Congress will take a look at the Grand Jury system and, in particular, at its potentially destructive consequences for our citizens. I plan to press for such an inquiry.

It's been a long and grueling experience, but I'm very pleased it all ended this way. So let me finish with some words from Shakespeare:

"Time's office is to fine the hate of foes; to eat up errors by opinion bred;...time's glory is to calm contending kings, to unmask falsehood and bring truth to light."

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The Europeans plan to build a Space Shuttle and the Soviets already are developing one. Indeed, while our Space Station is still on the drawing boards, the Soviets have two types of Space Stations in orbit. Mir, the newest and most advanced, is now occupied by two Soviet Cosmonauts who are preparing it for permanent occupancy and operation. Mir certainly gives the Soviets the edge over us for now in manned space operations. The Soviets plan to make it the core of a busy complex of space-based factories, construction and repair facilities and laboratories.

It is becoming increasingly clear that in the manned space arena, we have lost leadership to the Soviet Union.

China, Japan and India, while not yet major players in space, all have their own space programs and their capabilities are growing. Those nations, and others around the world, see space as an indispensable arena for scientific, industrial and national security activities. And they are right.

Indeed, it is time that all Americans awaken to the fact that both our friends and adversaries have well-planned space programs, a dedication to accomplishment, consistent and predictable space budgets and the confident to forge ahead.

This is indeed a crucial turning point in the history of the United States' space program.

It is a time to ask ourselves whether we can afford to let our competitors take the lead, while our own preeminence in space withers away.

And it is a time to set long-range national goals in space — goals of vision and purpose — and commit ourselves to attaining them.

Even as our space program recovers — and I'm confident it will come back stronger and better than before — it is time to set new directions and reassert America's leadership in space.

In deciding what our future goals in space should be, I believe we must begin by recognizing that our national resources may not permit us to be the leaders in every possible sphere of space activity. But what areas should we drop? It's not clear at this point that we can afford to drop any or to fall behind in any major space activity we're engaged in now.

If we decide that we can and must take the lead and keep it — and, to me, it is imperative that we do — then our next step is to fully understand that such leadership demands a sustained national commitment of will and resources.

What does such a commitment entail?

cont. on pg. 5

## It's Never Too Late!

The American scene has changed a lot in the last few years. However, textbooks on the principles of electrical engineering still aren't the kinds of books most grandmothers pack in their tote bags these days.

Enter Alice Miller, age 54, now an engineer at NASA's Marshall Space Flight Center (MSFC), Huntsville, Ala., and grandmother of six who earned her college degree last year from the University of Alabama (UAH) in Huntsville.

In 1982, after 22 years of working first as a chemical technician and then as an assistant chemist for two North Alabama companies, Miller found herself in what could have been a very depressing situation for any man or woman in their early 50s — she no longer had a job.

"I helped open one plant in 1970 and I helped close it down in 1982," Miller said.

The least attractive option, Miller recalls, was the unemployment line. "So, I said to myself, why not do something else."

For 3½ years, Miller, who had never taken a college course in her life, plowed through textbooks on electrical engineering as well as all the other courses required for an undergraduate degree in engineering.

"Many people think that my experience as an assistant chemist made it easier for me in my technical courses in college. That wasn't the case. The two weren't related at all."

In addition to the normal difficulties most students face in technical subjects, Miller also had to overcome some other obstacles to earn her degree. "I had one professor who had a hard time accepting the fact that a woman in her early 50s was pursuing a degree in a subject like electrical engineering. He always wondered why I was there."

Despite such circumstances, Miller persevered. "I was just too stubborn to quit."

Asked how her grandchildren and other family members viewed her efforts, Miller said, "Oh they were pleased and were behind me 100 percent. They were proud to see grandmother going to college."

Miller's reward came on May 31 last year when she graduated with a bachelor of science in electrical and computing engineering at UAH.

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Clearly, it goes beyond expenditures of funds. It extends to a strong and enduring belief in the importance of sustaining what America is all about: creativity, vision and dedication to the seemingly limitless possibilities that will transform our world and the people in it.

That is the kind of collective obligation we took on when we decided to go to the Moon; and the kind we need more urgently than ever today.

Today, we are preparing to build the Space Station.

It is crucial that all Americans recognize that the Space Station is the key to the United States' future in space. If we are to secure our leadership in space through the end of this century and in the early years of the next, we will need to be in space all of the time, not just some of the time.

The Space Station will not only make us permanent residents in space, but it also will be a stepping stone to future expansion there. The automated vehicles we will build with the Station will extend our reach within and between orbits.

Thus, the Space Station will serve as a transportation node and gateway to the universe. From an expanded Space Station, we can construct orbital service stations, where manned or unmanned spacecraft destined for other points in the solar system could be built, launched, maintained and refueled.

Two of NASA's recently-developed long-term goals are to work toward advancing scientific knowledge of the Earth, the solar system and the universe and to expand the human presence beyond Earth into the solar system. The Space Station will be an essential step in achieving both of those goals. In that respect, we at NASA see the Space Station as both a crucial near-term goal and as a vital program designed to help achieve long-term goals.

I think that double definition is important, because some have confused both NASA's programs and near-term goals with our long-term goals. We must remember that the Space Station is our logical next step because it will position the United States to tackle its next major long-term goal in space — be it a scientific base on the Moon or a manned expedition to Mars.

Faced with the choice of going back to the Moon or to Mars or not going at all, I believe we will choose the former course.

We should not and cannot be dismayed by the fact that cost factors in a Gramm-Rudman environment seem anomalous to some. On the contrary,

cont. on pg. 6

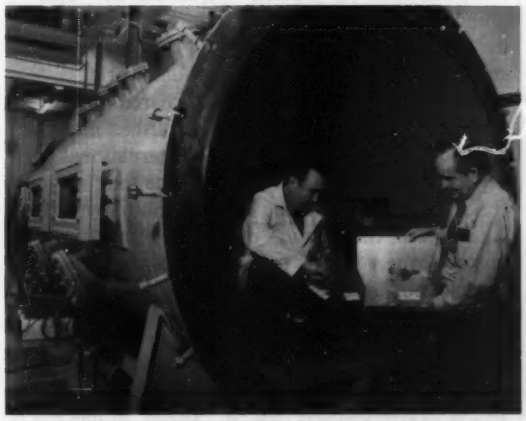
Now, she's employed at MSFC as a quality assurance engineer involved in such projects as the Space Shuttle Main Engine and the Advanced X-Ray Astrophysics Facility.

"My work here is very rewarding. However, earning a college degree in your early 50s is extremely tough. Your retention is just not what it used to be," Miller said.

Despite such obstacles, Miller appears ready to take the next step in her new career. "I would like to earn a masters degree if I can find the time," she said.

## Marshall Studying Space Debris Effect

Scientists and engineers at the Marshall Space Flight Center (MSFC) Huntsville, Ala., are using a "light gas gun" to study the effects space debris might have on long-duration orbital spacecraft such as NASA's Space Station.



Joe Lambert, left, and Hubert Smith hold up pieces of metal pierced by projectiles from NASA's "light gas gun". Both men work with the "gas gun" in MSFC's Micrometeroid/Space Debris Impact Facility.

The "gun" is part of MSFC's Micrometeroid/Space Debris Impact Facility and is located in the Materials and Processes Laboratory. The 60-foot long apparatus is being used to test the effects of projectiles striking sheets of metal. This testing simulates damage that space vehicles like the Space Station might suffer if struck by space debris.

"This facility is being used to test developmental structural configurations and candidate materials for long-duration orbital spacecraft," said Roy Taylor,

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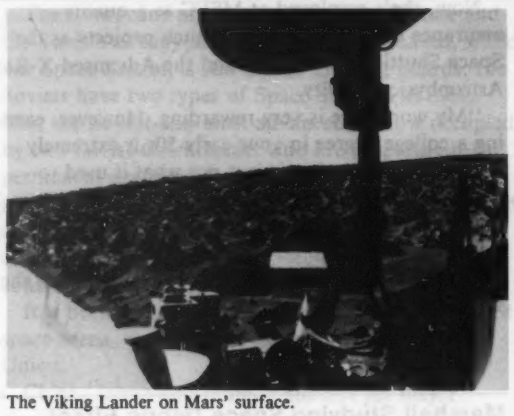

The Viking Lander on Mars' surface.

we should welcome the challenge of putting the most creative minds of the nation to work to direct most of our energies to ventures that are peaceful, stimulating and economically and socially invaluable.

Because the space program has become so much a part of American life, some of us tend to take its accomplishments for granted. We should not. This grand adventure has carried us far. It has expanded the boundaries of knowledge and of technology and changed forever the way we view our world.

In the past 13 years since I last shared my thoughts with you, we have accomplished much in space on our own and some with international partners. Our major achievements include the first joint U.S.-Soviet space project — the Apollo-Soyuz docking in space; the landings of Viking 1 and 2 on Mars; Voyager's visits to Jupiter, Saturn and Uranus; our European partners's development of Spacelab and our own development of the Space Shuttle.

Indeed, as we plan for the future, I believe there are no limits to how far mankind can go in space. And the United States, as it has in the past, can continue to lead the world in opening the space frontier.

The space program has been, and will remain, one of the most important catalysts for economic, scientific and technological progress on Earth. Leadership in space is a crucial element in sustaining United States' economic, scientific and technological leadership in the world.

So we are, indeed, playing for high stakes in space. And we Americans need to understand that well, as we decide our future course in space.

Whatever this nation decides to do in space in the future, one thing is clear: just as we got back more

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chief of the Laboratory Support Branch in the Materials and Processes Laboratory.

"Hydrogen gas is compressed through a piston and the compressed gas accelerates a projectile at speeds up to 26,000 feet per second. The piston is accelerated by a 300-gram powder charge. The powder in turn is ignited with an electric squib," he said.

Taylor said that projectiles ranging from 2.5 to 12.7mm in diameter are fired at sheets of metal. The sheets of metal are then analyzed to determine how future spacecraft might be effected by space debris.

"We are working with Boeing to do the test samples, so that they can analyze and fulfill their test requirement for a damage control and penetration study contract they have with MSFC," Taylor said.

The "gun" was originally purchased in 1965 to fill a need for meteoroid simulation to study the effects of micrometeoroid impacts on materials and various spacecraft structural designs. Several approaches had been taken to the problem of accelerating projectiles to hypervelocities, but the light gas gun is the only system capable of routinely launching projectiles of variable dimensions, mass and velocity.

"The gun was used in the late sixties for micrometeoroid testing for Skylab. It was inactivated in 1971. Then, in July 1984 due to the increased interest in the possibility of collision with meteoroids and orbital debris, the facility was reactivated. We began our first testing for Space Station applications in August 1985. Thus far, we have performed over 480 tests for Space Station work," he said.

Skylab was America's and the world's first space station. It was launched May 14, 1973. Three different crews flew their Apollo spacecraft to Skylab. The final mission lasted 84 days. The space station reentered Earth's atmosphere on July 11, 1979.

Another type of testing will be starting soon using another portion of the space debris impact facility.

"At the other end of our light gas gun we are configuring a large test tank. We will launch a projectile of sufficient mass and velocity to cause a penetration and assess the internal effects," Taylor said.

"It will be used in the evaluation of penetrations into an equipment module for the Space Station. We want to find out what the effects of penetration into a module actually are. If we have penetration, what kind of pressures are there? What kind of flashes are there? What is the noise level inside a module? That big tank will simulate a piece of space debris impacting a spacecraft," Taylor said.

from the Apollo program than we put into it, so we will reap rewards we can hardly imagine today from our continued investment in space development.

It would be unthinkable to turn back now — to slow down or stop our enterprise in space. In this increasingly competitive world, great nations can't afford to mark time. If they are to move ahead, they must set new goals and undertake new challenges.

America is still a pretty good country — in my mind, the greatest in the world — ever! We can still lead the world in most important endeavors. And space is no exception.

Now is the time to renew the spirit that got us to the Moon, and to move forward to lead mankind toward still greater achievements in space and the benefits they will spawn on Earth for this generation and for generations to come.

## New Software Package Developed

A 7-member team from the Communications Systems Branch of the Space Communications Division at NASA's Lewis Research Center (LeRc), Cleveland, Ohio, has developed a new software package designed to help an international conference give nations allotments for communications satellites in geostationary orbit in the C- and Ku- frequency bands. The package, called Numerical Arc Segmentation Algorithm for a Radio Conference (NASARC), took 9 months to complete.

The 7-member communications team consists of: Standing, Left to Right: Wayne A. Whyte, Jr., Ann O. Heyward, John E. Zuzek, Edward F. Miller. Seated, Left to Right: Dense S. Ponchak, Rodney L. Spence, Kenwyn J. Long.

NASARC was delivered to the International Frequency Registration Board (IFRB) in Geneva, Switzerland where it was successfully installed and run on test cases.

NASARC is expected to be a major software tool for the allotment planning for the Fixed-Satellite Service in certain frequency bands scheduled to take place at the 1988 World Administrative Radio Conference (WARC '88). The conference, which will be held in Geneva, is expected to attract representatives from more than 100 nations.

"The use of NASARC at WARC '88 will enable planners to develop an allotment plan that will satisfy the concerns of Third World countries about access to the geostationary orbit, while providing the flexibility needed to adapt to technology improvements vital to the U.S. and other technologically developed countries," explained Wayne Whyte, software development team leader.

Planning is necessary because the communications frequency spectrum and geostationary orbit are limited natural resources. The geostationary orbit is a particularly useful orbit for communications satellites, because a satellite placed in this orbit appears stationary when viewed from the surface of the Earth.

At the 1985 WARC, the delegates agreed that an allotment plan would be developed for the Fixed-Satellite Service in C- and Ku- frequency bands. The plan would be implemented by the IFRB.

Many nations favored an "a priori" plan, in which nations would be assigned specific satellite positions in the geostationary orbit. Many other nations, including the United States, favored a more flexible plan that would accommodate advances in satellite communications technology, provide freedom of choice in satellite location and achieve a more efficient use of the orbit.

The only planning software available to the IFRB at the end of WARC '85 was conducive only to the development of an "a priori" plan. Thus, nations were invited to submit software that could be used to develop other types of allotment plans.

NASA and other U.S. agencies involved in preparation for WARC '88 quickly realized that a United States effort to develop software to accomplish satellite orbit/spectrum planning on an international scale would have a direct impact on the outcome of the conference. It also was recognized that the Communications Systems Branch at LeRC was best equipped to undertake the software development effort.

Branch Chief Dr. Edward Miller, who had served as a U.S. delegate to WARC '85, asked Wayne

Whyte to lead an allotment planning software development team.

The team first formulated a concept of what the allotment plan should be. This required intensive examination and interpretation of the planning guidelines set forth at WARC '85. These guidelines included the following:

- Each nation is to have "guaranteed access" to the orbit;
- Each nation is to receive an allotment consisting of a satellite "orbital position" within a predetermined arc" and
- Each nation is to receive a full 800 Mhz of frequency bandwidth in which to operate.

The task of interpreting the guidelines was complicated by the fact that precise definitions for certain features of the plan, such as "pre-determined arc", were not agreed upon by WARC '85 participants.

"We were faced not only with developing a method for generating pre-determined arcs, but also with the need to define the pre-determined arc in a manner that would be equitable to all countries involved," says Whyte. After considering the options, the allotment planning team found that having groups of "compatible" countries share segments of the geostationary orbital arc would result in the greatest flexibility and most efficient use of the orbit.

The team then worked on a method to determine groups of "compatible" countries that could share arc segments, define the arc segments over which such groups could exist and select groupings and "pre-determined" arc segments suitable for an allotment plan.

If satellites can be placed closely together within an arc segment, near-complete flexibility of satellite positioning results. Thus less of the segment must be used to provide orbital spacing between satellites. Compatible countries were defined as those whose satellites could be placed closely together in orbit without causing excessive interference to either satellite's service area, under a given set of technical parameters.

The NASARC software package consists of two major computer programs: the first determines groups of compatible countries and the arc segments over which the groupings exist; the second selects groupings and arc segments most appropriate to an allotment plan. Also included is complete documentation in the form of a technical manual and user's manual.

Dr. Miller and software development team members Rodney Spence and John Zuzek returned from a week-long series of working meetings and demonstrations of the software for IFRB personnel in Geneva. The team members reported that the IFRB response to the software and documentation was very favorable.

"The NASARC software is unique in the world," says Dr. Miller. The IFRB indicated that no similar developments are underway."

While the NASARC software represents Lewis' most significant contribution to international satellite planning to date, it is not the first. Another program, the Spectrum/Orbit Utilization Program, developed under contract to LeRc was used extensively at a Regional Administrative Radio Conference held in 1983 to plan the Broadcast Satellite Service in the Western Hemisphere. Many other contributions have been made since Lewis' involvement in the international planning arena began in 1971.

## Fuel-Saving Propfan Engine Begins Tests At Lockheed-Georgia

Lockheed-Georgia Company, Marietta, Ga., is flight testing an advanced, fuel-saving propeller called a "propfan," in a $56-million NASA Lewis Research Center-sponsored research program.

Aircraft equipped with propfan propulsion systems will burn 15-30 percent less fuel than the most advanced turbofan-powered aircraft flying in the 1990s, while flying at the same speeds.

The propfan is a revolutionary-type propeller with eight or more thin blades and highly swept tips. The

The Propfan in flight.

blades are swept back like the wings of a jet aircraft for greater efficiency at high speeds.

The propfan propulsion system is mounted on the left wing of a Gulfstream II business jet. Data gathered in the flight research program will aid engineers in designing a new generation of propfan-propelled aircraft.

The 150-hour Propfan Test Assessment (PTA) research flight test program is specifically aimed at evaluating the structural integrity of the propfan blades, investigating associated propfan-related cabin noise and vibration and evaluating propfan noise impact on communities. The PTA research effort also is aimed at validating technologies and analyses codes critical to developing high-speed propellers.

The research flights are to be conducted at the Lockheed-Georgia Co. facility. The flights will cover test points ranging from 1,000 to 35,000 feet above the ground and Mach 0.8, about 550 miles per hour. The two jet engines on the testbed aircraft will provide the prime propulsive power during the flight tests.

Extensive instrumentation on the testbed aircraft, microphones, accelerometers and other instruments, will record more than 600 data parameters during the flight tests. This instrumentation and the highly controlled test conditions will give design engineers confidence in the PTA flight test data.

Propfan noise, on how the noise gets into the cabin and how to efficiently dampen this noise, is a crucial issue in developing the new propfan technology.

Lockheed-Georgia Co. will design and fabricate an acoustic treatment test section in 1987 and will install it in the PTA testbed aircraft for flight testing in late 1987. The flight test will be aimed at determining how effective this acoustic treatment is in attenuating propfan noise.

Acoustic treatment technology development, after the 150-hour PTA research flight test program, will continue under the initiative of NASA's Langley Research Center, Hampton, Va.

Lockheed-Georgia Co. is responsible to NASA's Lewis Research Center, Cleveland, Ohio, for overall design and management of the PTA program. In addition to Lockheed-Georgia, the PTA industry team includes Hamilton Standard Division of United Technologies, Windsor Locks, Conn.; Allison Division of General Motors, Indianapolis, Ind.; Rohr Industries, Inc., Chula Vista, Calif.; Gulfstream Aerospace Corp., Savannah, Ga.; and the Lockheed-California Company, Burbank, Calif.

On May 23, 1987, NASA's 1985-87 Presidential Management Interns (PMIs) met at the Coolfont Conference Center in Berkeley Springs, West Virginia, for final program briefings before completion of their 2-year training program and subsequent conversion into the competitive federal service. While at Coolfont, the PMIs were cited for their exceptional management potential as managers who have received special training in the planning and management of public programs and policies.

From left to right. (In front of sign) Richard Arbuthnot, JSC; J. Scott Spell, KSC; Greg Davidson, HQ; Steve Cook, HQ; Gregory Williams, HQ; David Kurtz, HQ; William Marshall, HQ; Janet Rowlands, JSC; Amy Kennedy, JSC; Beth Beck, JSC; Beth Caplan, JSC; and, Carrie Sorrels, HQ. (Photograph by Mia Anderson, '85 PMI, Department of Energy, Washington, DC).

Below is a copy of a letter—sent from Ronald Reagan—congratulating the 1985-87 PMIs on completing their program.

THE WHITE HOUSE
WASHINGTON

June 18, 1987

It gives me great pleasure to send you my congratulations as you successfully complete your Presidential Management Internship. I want you to know how much I appreciate your contribution to my Administration over the past two years.

The alumni of this program have the potential to become the leaders of the Federal work force and the Nation. The American people look to extraordinary individuals like you to develop your potential to the fullest and to help guide the search for answers to tomorrow's critical questions.

Nancy and I wish you great success in the challenging years ahead. God bless you.

Sincerely,

Ronald Reagan

## NASA's Employees Receive Arthur Flemming Award

Dr. Bruce J. Holmes, head, flight applications branch, low-speed aerodynamics division at NASA's Langley Research Center, Hampton, Va., and Mr. Samuel L. Venneri, director of materials and structures division, NASA Headquarters, Washington, D.C., were presented the Arthur S. Flemming award on May 7, 1987.

Holmes and Venneri were two of ten outstanding federal employees of 1986 to receive this prestigious award.

The Arthur S. Flemming award honors outstanding individuals in federal government on a specific accomplishment, general accomplishment and community involvement.

Dr. Holmes

Mr. Venneri

Holmes received the award for his outstanding contributions to a research program on the application and demonstration of natural laminar flow principles.

Holmes' research efforts over the past 7 years include developing improved flow visualization techniques using sublimating chemicals and liquid crystals to display the boundary transition behavior, conducting experiments to determine the extent of natural laminar boundary-layer persistence on modern smooth aircraft surfaces and developing and validating design criteria for surface requirements and production tolerances.

The extensive experiments and analyses conducted by Holmes have conclusively established the facts that natural laminar flow can be achieved on modern, smooth, production aircraft surfaces, and that many earlier concerns about laminar flow durability and maintainability were not warranted for many applications. The results of his research were sufficiently convincing to the U.S. aviation industry to generate renewed interest and acceptance of the use of laminar flow applications on new aircraft designs.

Holmes earned bachelor and master of science degrees in aerospace engineering, as well as a doctorate in engineering from the University of Kansas. The author or co-author of 50 technical publications, Holmes is a member of Sigma Gamma Tau (national aerospace engineering honor society), American Institute of Aeronautics and Astronautics and Experimental Aircraft Association.

In 1986 Holmes received a NASA Exceptional Engineering Achievement Medal and the AIAA Aerodynamics Award for his work in natural laminar flow. In addition, he has received four individual NASA Special Achievement Awards and three NASA Group Achievement Awards for his aeronautical research accomplishments.

The other award recipient, Mr. Venneri, provided outstanding leadership and creative management in research for advancing materials and structural concepts to ensure structural integrity, safety, durability, acceptable dynamic performance, low weight and economic production and maintenance. As a pivotal NASA manager, his contributions in research and associated technology have resulted in the initiation of innovative advanced research efforts and state-of-the-art facilities that will provide the technology base required for future aeronautics and space vehicles and missions beyond the existing National Aero-Space Plane and Space Station.

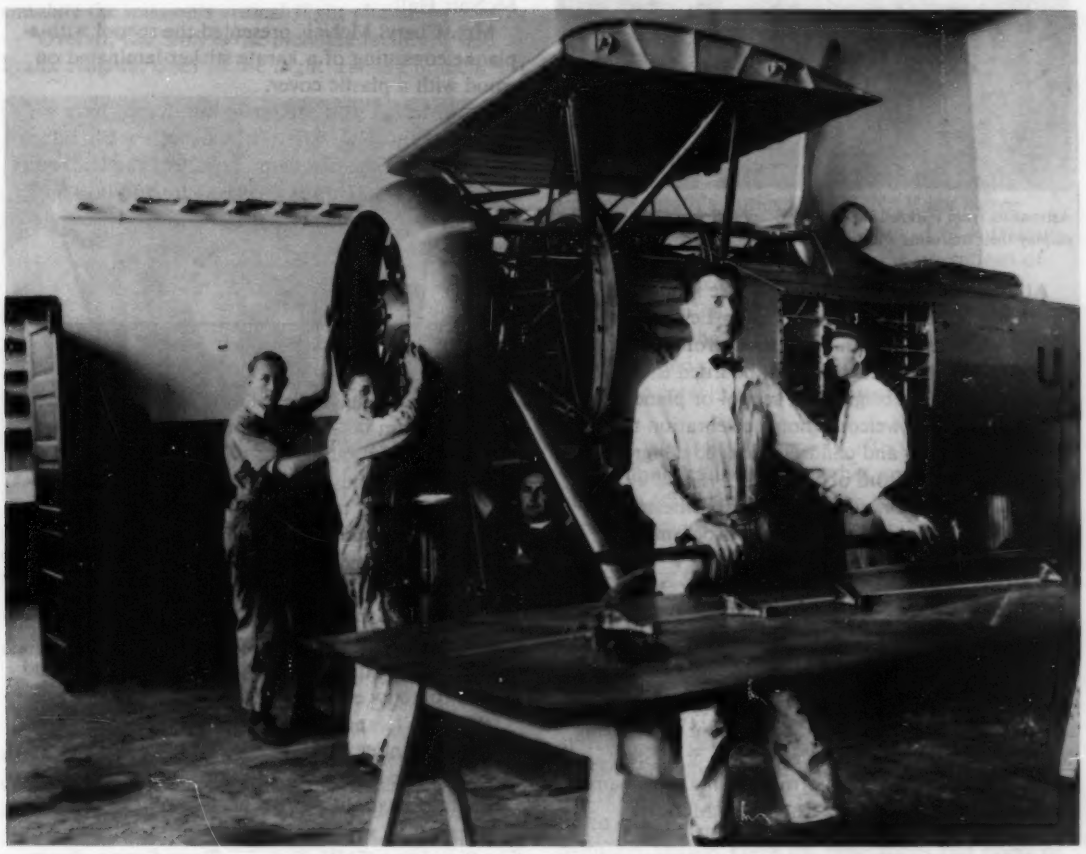
Venneri has made outstanding contributions to the community through his involvement and leadership in youth activities. He has provided guidance to students with an interest in aviation in an effort to facilitate their understanding of the various career opportunities available and to assist in achieving their goals. Venneri has devoted his career to preserving our national leadership through technology advancement, and a major portion of his personal life to sharing his enthusiasm and love of aeronautics and space technology with others.

This is the 39th year that The Downtown Jaycees have presented the Flemming Award to recognize young men and women who have performed outstanding and meritorious work for the federal government.

## Celebrating 70 Years of Research — Determination to Shape Tomorrow

On July 17, 1917, ground breaking ceremonies were held for the Langley Memorial Aeronautical Laboratory. This year, NASA's Langley Research Center celebrates its 70th anniversary with the theme "Shaping Tomorrow".

In the 1920s, aeronautical engineers concerned themselves with the problem of reducing the drag of radial engines without degrading their cooling. Under the direction of Fred E. Weick, head of the propeller research tunnel section from 1925 to 1929, engineers designed ten different cowlings for experimentation. The cowlings varied from a bare engine with no cowling at all, to a completely enclosed engine.



## 5000 Cleveland Area School Children Stage April Simulated Shuttle Launch

The metamorphasis consisted of school buses turned Space Shuttles, classrooms and entire schools changed into planets and galaxies and elementary students turned into astronauts. The event was a simulated Space Shuttle launch conducted by thousands of Cleveland area school students on April 8.

The purpose of this event was to bring alive for students, the classroom study of science, math and space-related topics. The students participated in every aspect of a Shuttle launch, including countdown, liftoff, planning and conducting onboard experiments and debriefing after landing.

Each school redesigned a school bus in the image of a Space Shuttle. On board each Shuttle, each appropriately named by the students, was a team of astronauts, computers, experiments and 2-way radios. The event got underway at nine different schools the morning of April 8 with liftoff from the site.

Astronauts from Parkroll Elementary School, Berea, Ohio, proudly display their uniforms and their Shuttle.

At about 11 a.m. EST each Shuttle rendezvoused with their partner school at NASA's Lewis Research Center Cleveland, Ohio. Here the astronauts met, conducted experiments and then boarded the Shuttle for return to their originating school or planet.

That evening a welcome home celebration took place and parents and children received congratulatory messages from officials.

Cleveland area organizations and businesses supported the simulated Shuttle flight program.

## Engineering Building Named In Honor Of McNair

On June 12, 1987, a new $8.5 million engineering building, located at North Carolina A & T State University, Greensboro, North Carolina, was named in honor of astronaut Dr. Ronald E. McNair.

Ronald E. McNair Hall was named for the graduate of North Carolina A & T who died while serving as a mission specialist aboard the Shuttle Challenger.

McNair, an accomplished saxophonist and karate instructor, was the first graduate of a historically black university to be selected for the astronaut program.

The building contains 94,400 square feet of space. A computer center, rooftop solar demonstration facility, television center and a 300-seat capacity auditorium are among some of the features of McNair Hall.

Mrs. Cheryl McNair presented the school with a plaque consisting of a karate sticker laminated on wood with a plastic cover.

Mrs. McNair said she knew Ron would have wanted the school to have it. Chancellor Dr. Edward Fort accepted the plaque on behalf of the University and said it would always have a sure and lasting place in McNair Hall.

## Trust

Trust, according to the Shuttle Mission Simulator Training Team instructors working with the STS-26 crew, is an essential part of good training. It also is something that must be earned.

"The crew has to believe you when you say, that is the best way to do it," said Bill O'Keefe, the team's control/propulsion instructor. "It takes a while to develop that trust."

Trust comes through demonstrating competency and subject knowledge, communicating on the same level, avoiding answers that just "sound good" and getting to know each other as individuals.

"We don't expect them to know all the answers," said Commander Rick Hauck. "But we depend on them to defer answering questions until they are confident they have the correct answers.

The recently assigned members of the Shuttle Mission Simulator (SMS) Training Team 9 were chosen because of the trust they earned training previous missions. Team 9 consists of team leader Rick Bush and instructors Stephen Messersmith, data processing systems and navigation (DPS/NAV);Darrel McGregor, systems; Bill O'Keefe, control/propulsion (Control/Prop), and Air Force Capt. Mae Black, Communications (COMM).

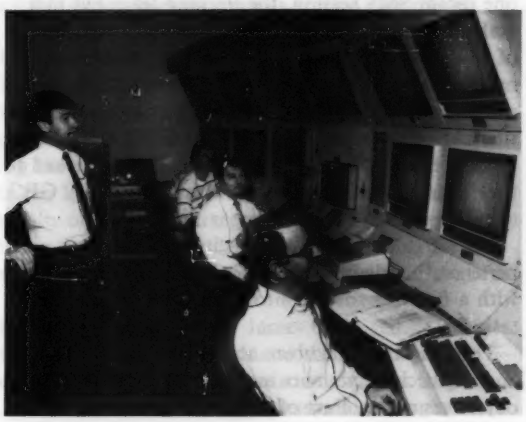
Although they have been working with the STS-26 crew for several weeks, the relationship between crew and instructors is still in its infancy.

"We're just getting to know each other," said Bush, who was the control/propulsion instructor for missions 51-B and 51-J. "Our training methods vary

according to the personality of the crew. We have to mold a training program to the personal contacts."

Trust is especially important between the crew and the SMS training team because it is the team leader who coordinates and executes all of the SMS sessions. Each crew goes through in its year of rigorous mission preparation and it is the training team that works the console during these sessions that fully simulate the mission's critical flight phases.

"Overall, the SMS is the premiere facility," said Frank Hughes, chief of the flight training branch.



Messersmith, O'Keefe and McGregor sit at their instructor stations in the motion-base Shuttle Mission Simulator control room as team leader Bush stands to get a better vantage.

"It's the highest priority that every crew puts on its training."

"The training we get in the SMS is mandatory for flight," Hauck said. "It is absolutely essential."

"Over the years we have used crew feedback to the folks who provide the motion cues and aural cues, such that at this point I think we have an excellent sim in that respect," Hauck added. "We also find that the SMS is essential for providing a place to verify the procedures we use in flight and it has provided us with an excellent facility to get shelf-life or maturity in flight software."

All that equipment and the $5,000-an-hour SMS sessions still depend on people to design the simulated missions, develop the training software loads and insert the malfunctions that put the astronauts to the test.

I'm very pleased with the experience level and the quality of the training instructors that we have," Hauck said. "They are all very knowledgeable and professional in their approach to our training task."

As team leader, Bush is working closely with Hauck to design a training program.

Bush also serves as liaison with the training manager, Dudley Long, who develops the schedules the crew uses to budget its time in the SMS and other training facilities. Bush makes real-time adjustments to changes in the Shuttle program, staying current with changes in the Flight Data File and Orbiter hardware and software to be sure all training is based on the most current procedures and capabilities. During console sessions he coordinates with the SMS operators who enable the aural, visual and motion cues of the simulator.

O'Keefe, as control/prop instructor, trains the crew in the Shuttle's main propulsion system, orbital maneuvering system, reaction control, flight control and portions of guidance and control.

Messersmith's duties as DPS/NAV instructor cover two separate areas. A veteran of 61-B training, he trains the crew to understand the operations of the Shuttle's five General Purposes Computers (GPC). These include the primary and backup flight systems, and the numerous interfaces between the computer and other Shuttle systems. In addition, he trains the crew in the management of navigation systems.

Black will train the crew to effectively use all of the communication systems that provide 2-way voice and data transmissions between the Shuttle and ground stations, payloads and extravehicular activity astronauts. She will train the crew in the use of S-band, KU-band and UHF linkages and Shuttle internal communications.

The five main systems that McGregor teaches the crew about are electric power production and distribution, environmental control and life support, auxiliary power units and hydraulics, mechanical systems, and caution and warning systems. McGregory worked with the 61-C crew.

Crew training usually starts out general and works up to specifics. But the experienced STS-26 crew members already know the generalities and many of the specifics, so the training team initially is throwing a broad range of problems at them to determine their strengths and weaknesses.

"I'll spread out my bag of tricks and see how they react to them," Messersmith said. "I'll see where they're weak and where they're strong. Already I'm finding that I'm going to have to work to challenge them. From now until the day we fly my job is to get them to know my systems well enough to anticipate the next worst-case failure and be prepared for it."

"We try to overstress the crew," Hauck said. "When we get into integrated sims, we try to train

to a level of failures that is much greater than we would expect on any mission. We try to provide a margin of knowledge and experience that will make any level of failures that we might see in flight well within our experience base."

Members of SMS Training Team 9 coordinate simulated malfunctions during a script-writing session for the STS-26 crew.

Right now, the STS-26 crew members are spending 4 hours a week in stand-alone SMS sessions. As the launch date nears, they will spend more time in stand-alone SMS sessions, and begin integrated sims that link the SMS and other stand-alone trainers with the Mission Contol Center through the Network System Simulator. The crew also will work with experts on its payload, the Tracking and Data Relay Satellite, during stand-alone and joint integrated sims.

Initial SMS stand-alone training will be provided by Air Force Capt. Stu Keister.

For SMS Training Team 9, preparation for each of the weekly sessions begins almost the minute the previous session ends. They take the lessons they learned about the crew's proficiency and begin to design new scenarios for the following week's session. Each instructor thoroughly researches the malfunctions, planned for the session and a "bag of tricks" for the script-writing session. There, they cooperate to ensure that no instructor ruins another's training objectives by overtaxing the astronauts or putting in malfunctions that make it impossible for them to learn.

"You have to let them think about what they're doing," McGregor said. "They can't just be blindly doing switch throws—that doesn't help them."

All of the instructors agree that the most "fun" part of their jobs is interacting with the crew during SMS sessions. As they sit at their consoles, light pens poised on computer screens prepared to throw in a malfunction that should be especially challenging, their eyes almost twinkle in anticipation.

"In some ways it becomes a contest between two friends," O'Keefe said. "I'm saying, How long is it going to take them to figure this out?" and they're up there saying, "OK, what's O'Keefe doing?"

"You want to give them something sneaky, but something that's realistic," McGregor said.

Those "sneaky" malfunctions teach the crew how tiny problems can have grave consequences. During one recent SMS session, the training team put in a malfunction based on the premise that a tiny piece of solder had kept the switch used to select abort modes from working properly. As a result, the primary GPC told the crew to return to the launch site while the backup flight system (BFS) told them to do a trans-oceanic abort landing. The crew had to take action to match the BFS with the primary GPC to retain the capability of engaging the BFS.

"It's a game in a sense, but its a learning experience," added Messersmith. "If you can come up with a fun way for them to learn then it's not a task."

Teaching crew members about computers, systems and flight characteristics are not the only training objectives either. Part of the training team's job is teaching the crew how they can work together, particularly the commander, pilot and mission specialist, who sit together on the flight deck.

"Those three are almost like an orchestra," O'Keefe said. "They have to work separately and yet together. We have to figure out how to train them to work like that."

In the end, though, results are what really matter.

"The most rewarding part of being an instructor is the product," Bush said. "We get the crew trained for their launch and they make us look good because they've done well."

## SHARP Assists Students in Science and Engineering

Students from across the country will gain first-hand knowledge about science and engineering careers by working directly with a NASA mentor this summer.

The NASA Summer High School Apprenticeship Research Program (SHARP) is designed to introduce minorities and women to scientific and engineering careers through a structured work environment.

Academically-talented high school juniors, nominated by their schools, will work with a NASA scientist or engineer who serves as a role model for the 8-to 10-week paid internship.

SHARP, now in its eighth year, is managed by the NASA Headquarters Educational Affairs Division, Wash., D.C. It is implemented by faculty coordinators at eight participating NASA field centers.

Former SHARP student Nathan James said he appreciated the opportunity SHARP provided him. He will be a mentor this summer and hopes he can use his experiences to serve as a good role model.

James is a computer scientist at Goddard Space Flight Center (GSFC), Greenbelt, Md. He received a Bachelor of Science degree in computer science from the University of Maryland, College Park. James participated in SHARP in the summer of 1980. During his internship, he worked with an astrophysicist in the Interplanetary Physics Branch at GSFC. The results of his computer programs helped scientists make determinations about the behavior of the solar wind in their efforts to find out more about the sun.

It wasn't just the laboratory experience that helped him in his career, James explained. "The internship helped me understand the pressures that could exist in a working environment." In addition, James said hearing what professionals thought regarding career preparations and study skills was particularly helpful in making career decisions. "I really didn't know what I needed to do. Did I need to go to college? What skills did I need to do well in my particular field? The internship helped me put my career into perspective."

Another benefit of the program, James said, was the opportunity to interact with other SHARP students who had similar interests and goals. "They were headed in the same direction so exchanging information was exciting and helpful."

James suggests that minorities take advantage of opportunities such as SHARP. "I'm testimony that if you take advantage of it, it will work out and you'll learn from your experiences. SHARP helped shape my future."

## Did You Know?

**Scientist Dr. Burton I. Edelson** has left NASA Headquarters to join the Johns Hopkins Foreign Policy Institute (FPI) in Washington. Edelson will work as an FPI fellow in the field of science, technology and international affairs to help develop programs related to many of the issues expected to face the United States in the 1990s.

As associate administrator for space science for the past 5 years, Edelson was responsible for the management of all scientific programs. Spacelab missions, the Hubble Space Telescope, and the Galileo mission to Jupiter were among them.

**An Office of Exploration** has been created to coordinate agency activities that would expand the human presence beyond Earth, particularly to the Moon and Mars.

Dr. Sally K. Ride will serve as its acting assistant administrator until mid-August. She is scheduled to leave NASA in early autumn to assume a position at Stanford University. Dr. Ride has been in charge of a NASA study to determine a possible new major space goal for the United States.

The office will analyze and define missions proposed to achieve the goal of human expansion of the planet. It will provide central coordination of technical planning studies that will involve the entire agency. In particular, it will focus on studies of potential lunar and Mars initiatives.

The new office also will concentrate on mission concepts and scenarios, schedules, transportation requirements, facilities utilization, resources requirements and science opportunities.

**Dr. John M. Klineberg** was appointed director of the Lewis Research Center, Cleveland, Ohio, on May 29, 1987.

Klineberg, had served as deputy director of the Lewis center since July 1979. He came to Lewis from NASA Headquarters, Washington, D.C., where he was deputy associate administrator for Aeronautics and Space Technology. In this position, along with the associate administrator, he was responsible for the general management and direction of NASA's programs in aeronautics, space technology and terrestrial energy research and technology.

Klineberg joined NASA in 1970 at the Ames Research Center, Mountain View, Calif., where he did research in the area of transonic flow with particular emphasis on numerical methods for calculating boundary-layer separation. He became an internationally recognized expert in this field and presented his results at many major universities and national and international conferences.

A native of New York City, Klineberg graduated from Scarsdale High School. He received a B.S. degree in engineering from Princeton University in 1960 and a M.S. in 1962 from the California Institute of Technology. He earned his Ph. D in aeronautics and political science from CalTech in 1968.

**To honor the seven astronauts** who perished on board the Space Shuttle Challenger in January 1986, the Virginia Tech class of 1988 incorporated into its class ring design an American flag and seven stars representing the astronauts. At the university's ring dance May 8, class officers presented to NASA officials a plaque with an enlargement of the ring design.

Representing the 361 Tech alumni currently employed by NASA the plaque was accepted by Paul S. Halloway and Dr. Jerry C. South Jr., both Tech graduates and employees at NASA's Langley Research Center Hampton, Va. On May 15 class officers officially presented the plaque to NASA in ceremonies at Langley. At this ceremony, the students were joined by William Lavery, Virginia Tech's president; Charles Forbes, vice president for development and university relations; and George Russell, executive vice president of the alumni association.

The Class of '88 at Virginia Tech is reportedly the only one in the country to honor the Challenger astronauts in such a manner.

The dedication of the Mississippi Technology Transfer Center, which took place on June 11, 1987, was a great and historic day for the state and NASA. Leaders in government, politics and business and higher education were on hand marking the beginning of a long-term partnership.

The $4 million building will create 250 jobs and allow the opportunity for Mississippi businesses to gain access to government technology previously unavailable.

Pictured above following the ceremony are: Mississippi Governor Bill Allain, left; Rear Adm. Richard Truly, standing; and NSTL Director Jerry Hlass.

## NSTL's Shuttle Engine Test Program Marks Milestone

An 850-second firing of a Space Shuttle Main Engine was conducted May 9 on the A-1 stand marking a major milestone in NASA's ground test program at the National Space Technology Laboratories, Bay St. Louis, Ms.

According to Boyce Mix, Marshall Space Flight Center's, Huntsville, Ala., Shuttle project office resident manager, the lengthy firing was the longest conducted in the history of the main engine test program.

Mix said, "In the past, we have always run mission duration tests on the main engines. But now we are beginning to move into limit-testing the engine system to demonstrate its additional marginal capability." A mission duration firing is 520 seconds, the approximate time the three main engines operate in an actual Shuttle mission.

Mix noted that the 850-second firing on engine 2105 provided sufficient margin of run time beyond that required of the main engines during the worst possible abort phase.

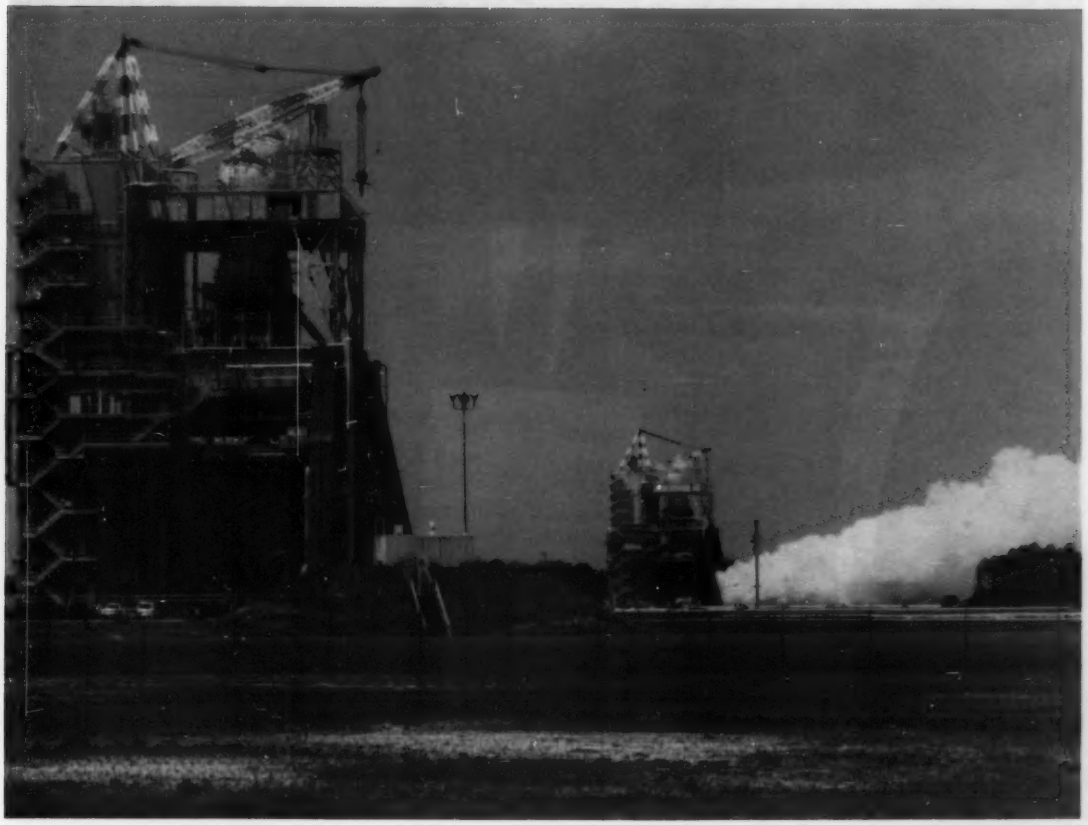
A 761-second firing was conducted on this same engine in February as a return-to-launch-site abort profile. The test simulated the actual duration an engine would be required to operate if one of the three main engines were to fail between liftoff and the point at which the next abort mode would be available. That mode would not begin until the solid rocket motors were jettisoned.

Mix said the 850-second firing also tested additional marginal limits of the facility functions which support the ground test program at NSTL. Those support areas include the high-pressure water and gas facilities as well as cryogenic propellants.

Engine 2105 is used only as a research and development engine for certifying design modifications and is not intended for use in an actual Shuttle flight. Mix said the engine has acquired 23,700 seconds of run time and NASA is planning to test the engine to 30,000 seconds before flights resume next year. He pointed out that all of the engine's components have not acquired this total amount of test time. He said, "Although the entire engine system has accumulated 23,700 seconds of run time, components are periodically being changed out for inspection. For instance, turbopumps require maintenance at 5,000-second intervals."

A modified nickel-plated main combustion chamber, which is stronger than those previously used, has acquired 13,192 seconds of test time on the engine. However, the powerhead and most of the running gear have remained on the engine throughout the duration of the test series.

Since the beginning of the year, 15,791 seconds of testing have been run on Shuttle Main Engines.



# Contractor News

NASA selected the **Lockheed Engineering and Management Services Company, Inc.**, Houston, Texas, for negotiations leading to an award of a contract for technical support services for the Earth Resources Laboratory (ERL) at the National Space Technology Laboratories (NSTL).

The award was effective Aug. 1, 1987, for a 2-year period. Estimated value of the cost-plus-award fee contract will be $9,000,000.

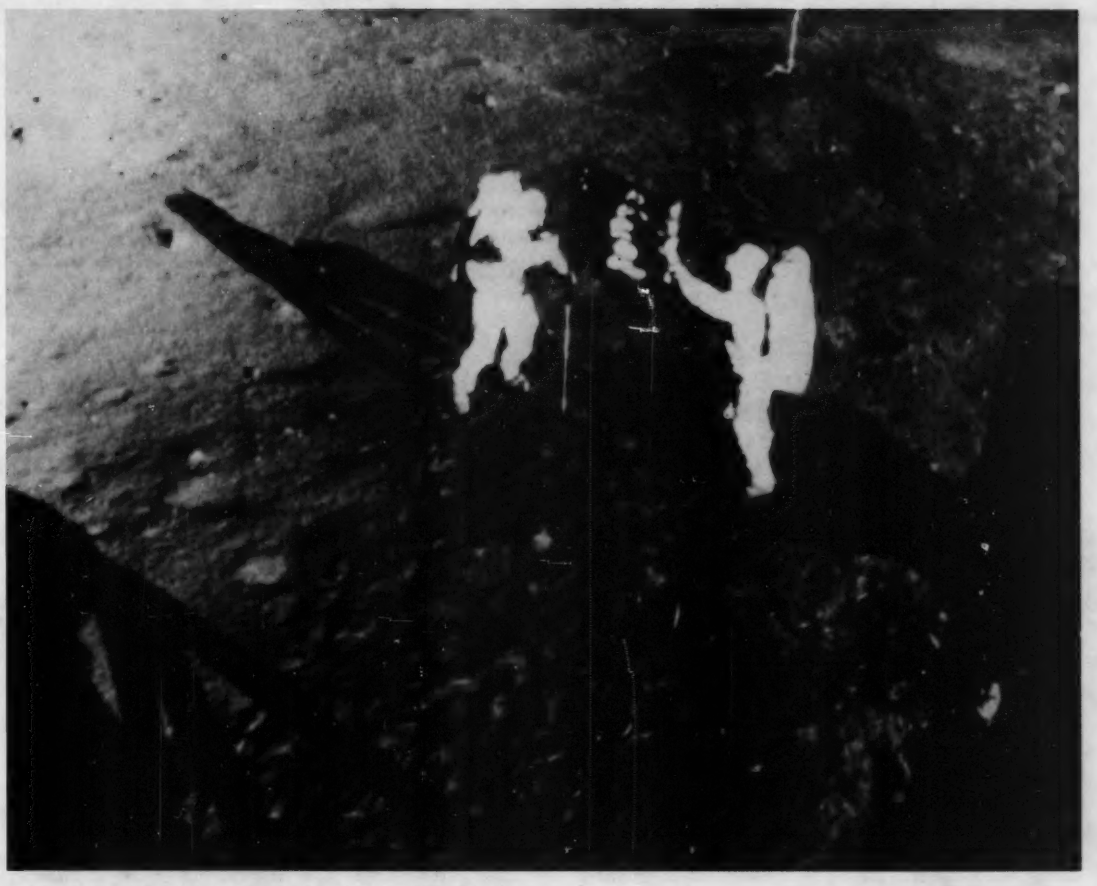
The technical services will support ELR's mission of remote sensing research and development. These services will support scientific, engineering, laboratory, field and data operations, including support in Earth science research, remoting sensing applications, research and remote sensing commercialization, data systems, remote sensor systems, aircraft operations and common support activities.

The National Aeronautics and Space Administration selected **Grumman Aerospace Corp. Space Station Program Support Division,** Bethpage, N.Y., for negotiations leading to award of a cost-plus-award-fee Space Station Program Support Contract (PSC).

The contract provides for Space Station Program Support Contract (PSC) and integration in addition to a broad base of management support to the Space Station Program Office.

Grumann's proposed cost (in real year dollars) for the currently planned performance period of approximately 11 years is $841 million, with a priced option for additional support of $406 million.

NASA Administrator Dr. James C. Fletcher is pictured here with two University of Pennsylvania students after participating in the University's distinguished lecture series on April 16, 1987. Dr. Fletcher addressed the overflowing student audience on the current issues affecting NASA and the agency's plans to getting back in space. Dr. Fletcher also was presented a plaque for being the 1987 distinguished lecturer.



Above is a picture, of the historic July 20 Apollo 11 lunar landing mission, showing the astronauts erecting the U.S. flag.

## About the Cover

The cover photo shows the 16-foot High-Speed Tunnel (HST), located at the Langley Research Center, Hampton, Va., which was used during World War II to test various air-cooled aircraft engines, cooling systems, high-speed propellers and shapes of the first atomic bombs. Both the 16-foot and 8-foot HSTs became the best testing facilities in transonic research. This picture, in the wind tunnel, shows the vanes that turn the airflow around one of the HST corners.

This year NASA's Langley Research Center observes 70 years of work in research and technology achievements.

**NASA Activities** is published bimonthly by the National Aeronautics and Space Administration for the information of the agency's employees. Contributions and recommendations are solicited from headquarters and field centers and should be addressed to editor, NASA Activities, News and Information Branch, Code LM, Washington, D.C. 20546.

NASA Activities is distributed free of charge only to agency employees. The publication is available by subscription from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Check or money order should be made payable to Superintendent of Documents, GPO. Subscription rates are $8.00/year, domestic; $10.00/year, foreign.

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# Another Dividend from Air and Space

**Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:**

## Citrus Inventory

An aerial color infrared (ACIR) mapping system, developed by NASA's Kennedy Space Center (KSC), Fla., has been adapted by Oliver Lowe, Property Appraiser for Florida's Charlotte County, for inventorying citrus trees as a basis for assessing citrus grove valuations. With ACIR, Lowe has been able to obtain more accurate property valuations while reducing the county's appraisal costs. In 1981, it took two appraisers 6 to 9 months to appraise the county's 8,500 acres of citrus. Today, survey of the county's 10,000 acres takes one appraiser about 75 days, with the help of the dual video system for interpreting ACIR photographs. The video system was jointly developed by KSC and the Citrus Research and Education Center of the University of Florida.

Aerial photographic flights were made annually each June during 1983-1985 and the resultant photos interpreted by the video system, composed of paired color video cameras connected to two monitors made it possible to view two different annual images and detect changes that may have occurred from one year to the next. Differences found were verified by field visits, which additionally served to determine the probable cause of tree losses, damage or decline.

Appraiser Lowe invites citrus growers to view photographs of their properties (individual property boundaries are outlined in the ACIR transparencies) and see for themselves areas where problems may exist, thus eliminating many potential tree failures and enabling growers to plant citrus in areas where better chances of successful growth are indicated.

The Florida State Department of Revenue would like to see development of an image analysis system that would automatically survey and photointerpret grove images. Such a system would make inventory and appraisal feasible and economical in counties with very large citrus acreages, where visual interpretation and data input would be too slow a process. KSC's Technology Utilization Office has awarded a contract to Dr. C.H. Blazquez of the Citrus Research and Education Center to adapt a prototype system that would automatically count trees and report a total of trees per block or grove.

*NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.